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It is Dr. Kollmann's opinion that human sub-species became fixed in the pre-glacial period, and that by the vicissitudes of time these have had greater or less influence upon varieties in different areas. The American continent, Eastern Asia and the Polynesian isles received only euthycomous varieties.

The accompanying table will exhibit Kollmann's scheme of the pre-glacial sub-species and varieties :

SUB-SPECIES.	PENETRATION.	VARIETIES, BY THE HAIR.
1. Chamæprosope—Dolicocephals (Long skulls, wide faces)	Europe North Africa West Asia	Cham. dolich. lissotrich. “ mesoc. “ “ brach. “ Leptopr. dolich. “ “ mesoc. “
2. Chamæprosope—Mesocephals (Medium heads, wide faces)		
3. Chamæprosope—Brachycephals (Short heads, wide faces)	America East Asia Polynesia	Cham. dolich. euthycoma. “ mesoc. “ “ brach. “ Leptopr. dolich. “ “ mesoc. “ “ brach. “
4. Leptoprosope—Dolichocephals (Long skulls, long faces)	Cent. Africa So. Africa Melanesia	Cham. dolich. ulotrich. “ mesoc. “ “ brach. “ Leptopr. dolich. “ “ mesoc. “ “ brach. “
5. Leptoprosope—Mesocephals (Medium heads, long faces)		
6. Leptoprosope—Brachycephals (Short heads, long faces)		

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MICROSCOPY.[1]

THOMA'S SLIDING MICROTOME.—Dr. R. Thoma, extraordinary professor of pathological anatomy at the University of Heidelberg, has been good enough to write us the following description (in English) of his instrument, which has acquired considerable reputation both on the continent and in England.[2] He adds also remarks on it use :

The microtome (Fig. 1) consists of a stand of cast-iron, on which slide two carriers. The large knife is attached to one of these, *a*, which slides horizontally. The second, *b*, holds the specimen to be cut. This second moves on an inclined surface, so as to raise the specimen as required.

This, with a few modifications, is the general character of all sliding microtomes; but hitherto the carriers were constructed to slide with two even surfaces between two even planes of the stand, which intersect at a given angle, with the consequence that all show more or less imperfect results, owing to the fact that it is impossible to obtain sufficiently exact plane surfaces. The inconveniences appear in small, scarcely perceptible irregularities of the movement of the carriers, and the consequent impossibility of making sections as thin as with an experienced hand.

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[1] Edited by Dr. C. O. WHITMAN, Newton Highlands, Mass.

[2] A description without figures appeared in Virchow's Archiv. LXXXIV (1881), pp. 189–91.

This induced Professor Thoma to enter upon a consideration of the geometrical and mechanical difficulties to be surmounted. The question to be solved was, how many points at least of a body sliding between two planes must touch the latter for this body to be perfectly steady in its position. It will be found that five points are sufficient, and that a carrier on five points, between two plane surfaces, will slide without difficulty between these planes, even if they are not absolutely geometrical planes, or the angle which they include is not everywhere the same. Such a carrier will always take exactly the same course; and in consequence a knife attached to it will cut a series of perfectly parallel sections through an object which is successively raised to a higher plane after each cut. The working of the instrument will therefore be far superior to any microtome with large sliding surfaces which nowhere exactly fit the sliding surfaces of the stand. This indicates the desirability of constructing the carrier for the object on five points also.

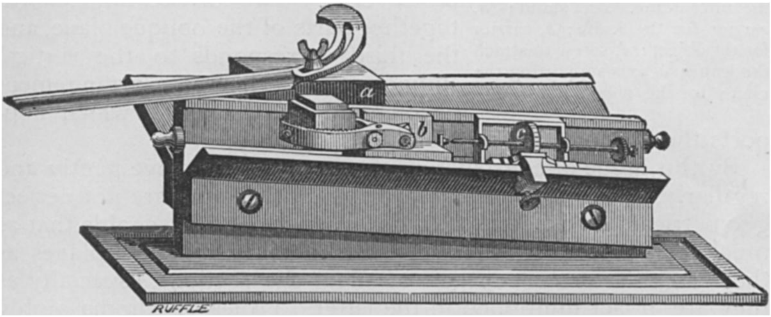

FIG. 1.—Thoma's microtome. *a*, carrier for the knife; *b*, carrier for the object; *c*, micrometer-screw for fine adjustment.

The construction resulting from these principles is simple and practical, but it is necessary to take into consideration the centers of gravity of the different sliding bodies. This, however, complicates the matter but very little. We replace the two sliding surfaces of each carrier by five slightly prominent points, and they will then move with exactness on any combination of two planes, not differing too much from geometrically plane surfaces. One condition only must be fulfilled, namely, that the five points are so chosen as to support steadily the center of gravity of the carriers, including their accessory parts, namely, the knife and object. Fig. 2 gives a more precise idea of the details of construction.

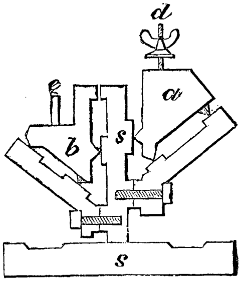

FIG. 2.—Transverse section of the microtome. *s s*, stand; *a*, carrier for the knife; *b*, carrier for the object; *d*, screw to attach the knife; *e*, axis supporting the clamp for the object.

In the figure the lower surfaces of the carrier *a*, which supports the knife, show three prominences, which gives the geometrical projection of the five points. Within the limits of the figure these points could not be drawn exactly as they are in the instrument itself. In reality they appear only as small prominences upon three narrow ridges on the sliding surfaces of the stand. This arrangement was desirable to facilitate the action of the oil with which the sliding surfaces are to be covered. Two of the ridges form together parts of the oblique plane, and the third corresponds to the vertical sliding plane. The same arrangement is found in the carrier *b*, which supports the clamp in which the object is placed.

By this mode of construction the carriers will move gently and regularly, even if the sliding surfaces on the stand are not perfect geometrical planes. It is still, however, of course desirable that as much exactness as possible should be obtained in these planes, as their irregularities cannot fail to affect the sections, especially as they are in fact multiplied in the latter. Professor Thoma highly commends Herr Jung, of Heidelberg, who makes the microtomes under his instructions, for the great exactness which he has obtained.[1]

As the efficiency of the newly-constructed instrument is best judged of by practical experience of its capabilities, Professor Thoma (besides stating generally that it has been found that any one can produce sections of great delicacy with this microtome without previous practice) gives the following facts: Specimens which are well hardened will allow of sections of three to four square centimeters surface and 0.015 to 0.10^{mm} thickness. In exceptional cases pieces of so large a surface may be cut of 0.005^{mm} thickness. If the section is smaller (for instance, one centimeter square), the thickness can be reduced considerably, say to $0.005^{mm,}$ or in extreme cases to half that. It is not, however, all tissues and objects that will admit of sections of such delicacy. Well-hardened liver may generally be cut to $0.015^{mm,}$ this being about the diameter of the hardened cell. Occasionally, however, in this tissue, sections of 0.010^{mm} can be obtained. Lymphatic glands and brain may be cut to 0.010 or $0.075^{mm;}$ embryonic tissues, well imbedded, usually admit sections of 0.005 and $0.003^{mm.}$ In some cases even sections of 0.002^{mm} thickness can be obtained. These numbers refer to the largest size of the microtome, and to serial sections. The two smaller sizes will give sections of the same delicacy, but comparatively smaller in extent of surface. The length of the sliding surfaces of the large instrument is $40^{cm,}$ and the edge of the knife is $23^{cm.}$ In the medium size these dimensions are 27 and $16^{cm,}$ and in the smallest about 21 and $11^{cm.}$

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[1] Professor Thoma remarks that at a time when already a number of his microtomes were in use, an instrument entirely different in its general appearance, but yet constructed on similar principles, appeared in America—the microtome of Mr. Fletcher (Boston *Medical and Surgical Journal*, 1880). The knife-carrier slides on five points on the bottom of a large basin filled with alcohol. This microtome shows such eminently different qualities to the one explained here, that the independence of the invention is on both sides very evident. The value of the principle, however, is at the same time demonstrated by the relative good results which have been obtained by this American machine. Its limit as regards the thinness of the sections appears to be 0.0004 in.

Professor Thoma also adds some practical remarks on the use of the microtome and the necessary previous preparation of the specimens, it being his opinion that further progress in section-cutting is to be expected from the perfecting and development of the technical methods of preparing, hardening, soaking and imbedding the tissues. Personally he feels sure that any tissue (excluding bone and teeth before decalcification) may be prepared so as to be cut to any degree of delicacy down to $0.002^{mm.}$ The microtome will work with sufficient exactness to permit this, but hitherto there are only a few tissues which we can prepare so perfectly as to admit sections of such extreme minuteness. The following are the points to which he most especially wishes to draw attention:

Sliding microtomes are in general constructed for cutting sections of tissues previously hardened in alcohol, picric acid, chromic salts and other agents. Fresh tissues are decidedly better cut by freezing microtomes, for instance, on the simple and practical instrument of Hughes and Lewis. The addition of a freezing apparatus to a thoroughly exact sliding microtome is neither advisable nor necessary. The differences of temperature produced in different parts of the instrument would be apt to interfere with the perfect planeness of the sliding surfaces; whilst, on the other hand, section-cutting with frozen tissues is so simple and easy with the ordinary freezing apparatus that any further complication in the way of a sliding support of the knife is superfluous.

In cutting the microtome is to be placed before the operator as in Fig. 1, with the sliding surfaces abundantly covered with oil (bone oil), and the knife moistened with alcohol. In many cases it will be sufficient to simply place the hardened specimen between the arms of the clamp attached to the carrier *b* (Fig. 1). The clamp should then be fixed in such a position that the specimen is as near as possible to the knife-carrier. The knife will generally have to be adjusted so as to bring the whole length of its blade into action. Very hard specimens are frequently cut with less difficulty by placing the knife more obliquely in regard to the long diameter of the instrument.

The inclination of the oblique plane upon which the carrier *b* slides is 1 : 20, and consequently the section will be 1-20th$^{\text{mm}}$ thick if the carrier is moved 1$^{\text{mm}}$ on the oblique plane. A scale in millimeters with a vernier allows the operations to be exactly regulated. The vernier will be found sufficient for sections of 0.015$^{\text{mm.}}$ Sections of greater delicacy should always be made by using the micrometer-screw (*c*, Fig. 1), which was designed to obtain the utmost exactitude in the management of the carrier *b*. Fig. 3 shows it on a larger scale.

The carrier *c'* slides on the same oblique plane as the carrier *b* which holds the specimen. In all positions of the latter it is therefore possible to bring the point of the micrometer-screw, *g g*, close to a small polished plate of agate, *f*, which is fixed to the carrier *b*. In this position *c* should be firmly screwed to the stand of the microtome by *d*, and every revolution of the micrometer-screw, *g g*, will then push the carrier *b* 0.3$^{\text{mm.}}$ The periphery of the drum, *t*, which is firmly attached to the screw, *g g*, is divided into fifteen equal parts; and consequently each division marks a thickness of section equivalent to 0.001$^{\text{mm.}}$ The finest sections hitherto produced reach only 0.002$^{\text{mm}}$ thickness.

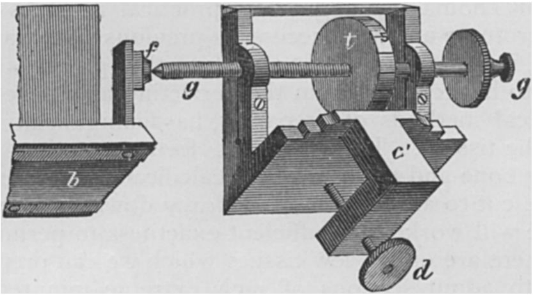

FIG. 3.—Micrometer-screw for delicate sections.

Since the first microtome was taken into use a series of minor improvements have been made. One of them consists in a clamp (Fig. 4) for holding the object, which can be turned round three axes, and admits, therefore, of a very easy adjustment of the object in regard to the knife. It was devised to meet the desire for occasionally turning the object between two successive series of sections.

The two metal plates, *h h*, form the jaws of the clamp. Between them is placed the cork which carries the specimen, and the latter is fixed by turning the screws, *g g*. The three axes are *a*, *b b* and *c c*, and round these the clamp can be turned, *a* being vertical, and *b b* and *c c* horizontal. In all positions these three axes can be made immovable by the screws *d e f.* The axis, *a*, is formed by the vertical rod, *e* (Fig. 2) on the carrier supporting the clamp and object. The details of the construction are partly new, and are very solid and durable. Their arrangement is such as to admit of a division of the circles in which the clamp can be turned.

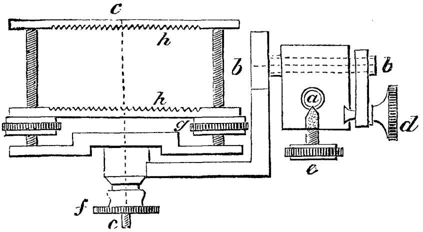

FIG. 4.—Clamp to be turned in three directions (as seen from above).

Another improvement has been devised by Mr. Jung. This is an arrangement which regulates the movement of the micrometer-screw in such a way that after a given number of divisions of the drum, a spring registers to the ear and finger of the manipulator the number of micromillimeters which the object has been raised. These intervals can be varied, within certain limits, by a simple adjustment comparable to a vernier. The construction of this apparatus is decidedly very elegant, but the divisions of the drum of the micrometer-screw are so large and easily visible, even to weak eyes, as in Professor Thoma's opinion to make such complications useful only for very special conditions.

Other improvements by different manipulators relate merely to secondary points, and do not touch the essential principles of construction.

Taking the hardened specimen directly between the arms of the clamp is generally not advisable, as by such a proceeding sections of great delicacy cannot be obtained. It should be fastened with gum arabic to the even surface of a square piece of cork, and the latter inserted in the clamp. In this way compression is avoided. A concentrated solution of the gum is placed on the surface of the cork, and the hardened specimen is watered a few moments to drive away the alcohol from the surface, and it can then be adjusted on the gummed cork and plunged again into alcohol. The latter will, in a few hours, harden the specimen as well as the gum, and we obtain a preparation like Fig. 5.

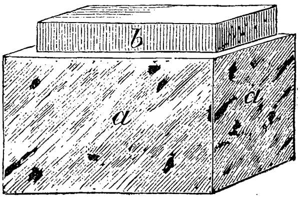

FIG. 5.—Hardened specimen *b* adapted to cork *a*.

These methods are sufficient for the great majority of cases, and the different animal and vegetable tissues can be cut into sections varying according to their structure, between 0.030 and $0.005^{\text{mm.}}$ Sometimes, however, and always if sections of extreme delicacy are required, it is necessary to use more complicated procedure. For example, the normal human lung hardened in alcohol and prepared as above, will perhaps admit of sections of 0.030^{mm}; a human lung affected by acute pneumonia may perhaps be cut to 0.015^{mm}, but if greater delicacy is required, the tissue must be soaked in gum arabic, or other substance which admits of a more solid hardening. In this case human lung will allow of sections down to 0.001^{mm}. Objects of very small dimensions, like embryos, small animals, leaves of plants, &c., must be imbedded in suitable masses, which may be adapted to a cork, as above, before they are cut.—[*To be continued.*]

SCIENTIFIC NEWS.

— In closing his second lecture on whales Professor Flower argues against the theory of the derivation of the whales from the Carnivora, and the idea that whales are an extreme modification of the seals and sea-lion, calling attention to the fact that the hind-limbs are aborted and the tail developed into a powerful swimming organ. He thinks it more reasonable to suppose that whales were derived from animals with large tails, which were used in swimming, eventually with such effect that the hind limbs became no longer necessary, and so gradually disappeared. "The powerful tail, with lateral cutaneous flanges, of an American species of otter (*Pteronura sandbachii*), or the still more familiar tail of the beaver, may give some idea of this member in the primitive Cetacea." He therefore suggests the derivation of whales from the lower Ungulates, and that the earliest forms were fresh-water types; the fresh-water origin of the group accounting for their otherwise inexplicable absence from the Cretaceous seas.

— The Chinese and Japanese exhibits at the International Fisheries exhibition must be novel and striking. An article in *Nature* calls attention to the extraordinary ingenuity displayed in utilizing the most ordinary and unpromising objects for the purpose of fishing. Thus in Swatow they employ a boat drawing a few inches of water, with the rail nearly level with the surface. A narrow plank fixed along one side is painted white, and the light of the moon falling on it causes the fish to mistake it for water. They jump over the plank into the boat, when they get entangled in moss or grass. At Ichang, a wild animal, such as the otter, is trained, not to catch fish, but to frighten them into the net; while at Ningpo cormorants are regularly and systematically trained to fish. These and many other devices shown at the exhibition mark the Chinese as the most ingenious and accomplished fishermen in the world.

— In his notice of MM. Carl Vogt and Emil Yung's treatise